SYSTEM AND METHOD FOR MOBILE LOCALIZATION USING FAKE LOCATION UPDATES

BACKGROUND

[0001] 1. Field

[0002] Embodiments of the invention relate to location area updating using telecommunication signaling protocols, such as, but not limited to, Random Location Area Update (LAU) and/or Random Routing Area Update (RAU).

[0003] 2. Description of the Related Art

[0004] Applications using technology such as Java Card, for example, can determine, through a mobile equipment—SIM (ME-SIM) interface, a visible set of base stations of a telecommunication network. Through server-side communication, these applications can provide location information on the whereabouts of the mobile equipment. Java Card refers to technology that allows Java applets to run on a SIM card. Java applets may be installed remotely to a SIM card using technology referred to as over-the-air (OTA) provisioning.

[0005] One telecommunication signaling protocol that may provide location information is Random Location Area Update (LAU). Within a Circuit Switched (CS) network, a mobile terminal may initiate LAU to refresh a location of the mobile terminal when crossing the border of two location areas. Both active and idle mobile terminals may initiate LAU.

[0006] Another telecommunication signaling protocol that may provide location information is Random Routing Area Update (RAU). RAU may be used within a packet switched (PS) network, and RAU operates in a similar manner as LAU. A mobile terminal may initiate RAU to refresh a location of the mobile terminal when crossing the border of two routing areas.

[0007] In general, signaling events communicated by the signaling protocols can be used for detecting the position of mobile terminals. Passive localization methods use signaling events without interfering with normal network operation. An example of a passive localization method is the processing of LAU or RAU events. WO 03/041031 A1 presents a solution for passive localization using LAU events.

[0008] On the other hand, active localization methods initiate message exchange with mobile terminals to obtain position information. An example of active localization is paging.

[0009] Additionally, "Tracking Vehicular Speed Variations by Warping Mobile Phone Signal Strengths" by Chandrasekaran et. al., 2011, IEEE International Conference on Pervasive Computing and Communications (PerCom), describes a solution to detect random locations by collecting signal strength information.

SUMMARY

[0010] One embodiment is directed to a method including defining mappings between coordinates of interest and fake location areas. The mapping may further include a measure of the probability that a mobile terminal is physically at a coordinate of interest or the accuracy of a location detection. The method may further include providing an application to a terminal, and distributing the mappings to the terminal. The method may further include receiving a location update generated from the terminal, wherein the location update is based upon a fake location area, and determining location information of the terminal based upon the location update.

[0011] Another embodiment may include an apparatus which may include at least one processor and at least one memory including computer program code. The at least one memory and the computer program code are configured, with the at least one processor, to cause the apparatus at least to define mappings between coordinates of interest and fake location areas, to provide an application to a terminal, to distribute the mappings to the terminal, to receive a location update generated from the terminal, wherein the location update is based upon a fake location area, and to determine location information of the terminal based upon the location update.

[0012] Another embodiment may include a computer program, embodied on a computer readable medium. The computer program may be configured to control a processor to perform a process including defining mappings between coordinates of interest and fake location areas, providing an application to a terminal, distributing the mappings to the terminal, receiving a location update generated from the terminal, wherein the location update is based upon a fake location area, and determining location information of the terminal based upon the location update.

[0013] Another embodiment is directed to an apparatus including means for defining mappings between coordinates of interest and fake location areas, means for providing an application to a terminal, means for distributing the mappings to the terminal, means for receiving a location update generated from the terminal, wherein the location update is based upon a fake location area, and means for determining location information of the terminal based upon the location update.

[0014] Another embodiment may include a method including receiving, by a terminal, an application, receiving, by the terminal, mappings between coordinates of interest and fake location areas, and generating, by the terminal, a location update, wherein the location update is based upon a fake location area.

[0015] Another embodiment may include an apparatus comprising at least one processor and at least one memory including computer program code. The at least one memory and the computer program code may be configured, with the at least one processor, to cause the apparatus at least to receive an application, receive mappings between coordinates of interest and fake location areas, and generate a location update, wherein the location update is based upon a fake location area.

[0016] Another embodiment may include a computer program, embodied on a computer readable medium. The computer program may be configured to control a processor to perform a process including receiving, by a terminal, an application, receiving, by the terminal, mappings between coordinates of interest and fake location areas, and generating, by the terminal, a location update, wherein the location update is based upon a fake location area.

[0017] Another embodiment may include an apparatus including means for receiving an application, means for receiving mappings between coordinates of interest and fake location areas; and means for generating a location update, wherein the location update is based upon a fake location area.